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Keywords: Distance education and telelearning, interactive learning environments, media in education, multimedia/hypermedia systems, simulations

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This study investigated the relationship among three types of presences, including place presence, social presence, and co-presence in virtual worlds and their relationship with satisfaction and immersive tendencies of students. Students’ scores on a subjective questionnaire were analyzed. The results indicated that there was a significant relationship among the place presence, social presence, and co-presence. While social presence seemed to affect the satisfaction most, place and co-presence also affected students’ satisfaction in the virtual world. Moreover, immersive tendencies of the students were related to their place and co-presence but not to their social presence. Findings highlighted the important issues for the design of virtual world environments to increase presence and satisfaction of students.

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1. Introduction

Throughout the evolution of web, stated as “*webvolution*” (Kapp & O’Driscoll, 2010, p. 7), focus has moved from “access and find” (Web 1.0), “share, participate, and collaborate” (Web 2.0) to “immersive collaboration and co-creation” (Web 3.0). As we move towards to 3D immersive and collaborative learning environments, the interest in the educational use of virtual worlds has been growing considerably.

Three-dimensional virtual worlds can be defined as a “customized setting that mirror the real world” (Horizon, 2007); “networked desktop virtual reality in which users move and interact in simulated 3D spaces” (Dickey, 2005, p. 439) and “immersed .. 3D virtual environment in which a learner acts through an avatar to engage with the other avatars for the explicit purpose of learning” (Kapp & Driscoll, 2010, p.55). As seen in the definitions, immersive three dimensionality of the environment, representation through avatars, and interactivity are the important characteristics of 3D virtual worlds.

Educators worldwide are trying to benefit from the affordances of these 3D technologies by investing large amounts of time and financial resources in research and development. Recently, variety of educational initiatives including universities, schools, and businesses have established locations for different purposes in the most common virtual worlds, Second Life and Active Worlds.

Educators have been utilizing virtual worlds for experiential and problem-based learning spaces for the learning tasks which are expensive, dangerous or impossible to be undertaken in real life (Dalgarno & Lee, 2010). By interacting with the objects, learners have the opportunity to practice, observe their actions, and learn by doing. Situating and contextualizing learning in authentic tasks and in virtual worlds can increase the transfer of knowledge and skills. Moreover, many universities and schools have been using 3D virtual worlds for distance education purposes as well as supplementing traditional classroom activities to promote communication and

collaboration among students (Dalgarno et al., 2011; De Lucia, Francese, Passero, & Tortora, 2009; Petrakou, 2010). Text based and audio based communication tools within simulated virtual worlds have been used to promote collaborative learning activities and role-playing (Cheong, 2010; Gao, Noh, & Koehler, 2008; Vasileiou & Paraskeva, 2010), and to facilitate communities of practices (Oliver & Carr, 2009).

Literature provides evidence of the potential of virtual worlds to create effective learning environments where collaborative learning is possible through immersive activities. However, current research focuses on how actually 3D virtual worlds facilitate teaching and learning; and studies stress the importance of presence and satisfaction in these environments. Different aspects of presence were described in the literature as place, social, and co-presence. Recently, studies have been conducted to examine the relationship among the different types of presences, and their effects on the satisfaction in 3D virtual environments. However, there is no consensus that how different types of presence affect each other and their relationship with the learners' satisfaction. The purpose of this study is to contribute to the field's understanding of the presence by examining the relationship among three types of presences: place, social, and co-presence. Moreover, the study aims at examining the relationship of the different types of presences with the satisfaction and immersive tendencies of learners in 3D virtual worlds.

2. Literature review

2.1. Presence in 3D virtual worlds

The concept of presence has been conceptualized differently across various theoretical models. Different dimensions of the presence in the literature can be grouped in three main categories as (place) presence, social presence, and co-presence.

2.1.1. Presence. Generally, in the virtual environment or virtual world literature, the term *presence* (also known as *physical presence*) is mostly used to refer the individuals 'sense of being' in a particular virtual environment (Sheridan, 1992). Slater (1999) defined presence as a

subjective and psychological sense and his definition included three aspects: The sense of ‘being there’, individuals’ response to what is ‘there’ as real or present, and individuals’ memory of the environment as a ‘place’ like in real life. Slater, Usoh, and Chrysanthoul (1995, p. 9) proposed that immersion which included “the extent to which the computer displays are extensive, surrounding, inclusive, vivid, and matching” affected the sense of presence. Moreover, Witmer and Singer (1998) defined presence as the “subjective experience of being in an environment, even when one is physically situated in another” (p. 225). They argued that presence depended on the ability to focus on the certain stimuli in virtual environment to the exclusion of the unrelated stimuli in real life. As a consequence of the focus and attention, individual can *involve* psychologically and attaches to the stimuli or activities. Moreover, individuals can be immersed which is defined as the “psychological state characterized by perceiving oneself to be enveloped by, included in, and interacting with an environment that provides a continuous stream of stimuli and experiences.” (Witmer & Singer, 1998, p. 227). They see involvement and immersion as necessary for experiencing presence. They proposed that higher degree of involvement and immersion in a virtual environment would result in higher levels of presence. Other researchers used different terms to explain this dimension of presence such as personal presence (Heeter, 1992; Slater, 1999), telepresence (Minsky, 1980; Sheridan, 1992; Steuer, 1992), spatial presence (Biocca, Harms, & Burgoon, 2003), and presence as transportation (Lombard & Ditton, 1997; Nowak, 2001).

2.1.2. Social presence. The concept of social presence was first introduced by Short, Williams, & Christie (1976) to compare face-to-face interactions with different communication media and comparing media with one another. They defined social presence as “the degree of salience of the other person in the interaction and the consequent salience of the interpersonal relationships” (p. 65). They proposed that communication medium could influence the intimacy and immediacy, and thereby, the way people interacted in either more or less personally. Argyle & Dean (1965)

suggested that the level of interpersonal interaction and intimacy was maintained at an optimal level through certain verbal and non-verbal behaviors such as physical distance, smiling, and eye contact. Furthermore, Weiner & Mehrabian (1968) defined concept of immediacy as the communicative and language behaviors that reduced the psychological distance between communicators. Media richness theory (Daft & Lengel, 1986) extended the concept of social presence to the inclusion of less subjective measures such as “medium's capacity for immediate feedback, the number of cues and senses involved, personalization, and language variety” (p. 560). Central hypothesis for the theories explained above is that level of social presence increase as the quality and the capability of the communication medium increases, from written, text-based media to face-to-face media. In addition to the quality of the medium, other researchers saw social presence as individuals' perception of the medium to connect them to each other and create sociable, warm, and intimate interaction (Lombart & Ditton, 1997).

2.1.3. Co-presence. In addition to the traditional conceptualization of presence as ‘being there’, and consideration of presence as social richness by relating to the media characteristics, researchers further conceptualized co-presence as a sense of being together and focused on more “psychological connection of minds” (Nowak, 2001). The term co-presence was originated by Goffman (1963) and was defined as a sense of being together in virtual environment where individuals become “accessible, available, and subject to one another” (p. 22). Biocca et al. (2003) argued that the definitions of co-presence which emphasized the sense of being in the same virtual place or environment related to some properties with place presence. On the other hand, others saw co-presence not only being in the same place, but also a mutual awareness of the individuals and emphasized the sensory properties of the virtual environment. Namely, co-presence consisted of two dimensions: having a sense of feeling of other individuals, namely perceiving others and having a sense of feeling that others were actively perceiving us and being part of a group (Goffman, 1963; Slater, Sadagic, Usuh, Schoeder, 2000). Co-presence is

distinguished from social presence in that while social presence relates to the quality of the medium and users perception of the medium, co-presence addresses more psychological interaction of the individuals (Nowak, 2001; Schroeder, 2002).

2.2. *Relationships among presence, social presence, and co-presence*

Research on the relationship among the different types of presences presents conflicting results. In comparing the behavior of small groups in a virtual environment, some studies found a significant positive relationship between the place presence and co-presence (Axelsson et al., 2001; Schroeder, 2002 ; Slater et al., 2000; Tromp et al., 1998). However, other studies claimed that place presence and co-presence were independent and they found no relationship between them (Bystrom & Barfield, 1999; Casanueva, 2001). Regarding the relationship between place presence and social presence, Thie and van Wijk (1998) found a significant positive correlation. On the other hand, in another study, Zhang and Zigurs (2009) found that social presence was related more to the overall course design than the place presence.

Some researchers saw place presence as orthogonal with co-presence (Slater et al., 2000) and social presence (Wang & Wang, 1998). For example, Slater et al. (2000) proposed that “talking on a telephone with someone might give a strong sense of ‘being with them’ but not of being in the same place as them” (p. 41). Moreover, people might experience social presence even the medium provides minimum physical presence; or medium might provide high level of place presence but not necessarily social presence (Wang & Wang, 2011).

2.3. *Presence and Satisfaction*

Learners’ satisfaction is an important research area and researchers have been examining the factors that affect learners’ satisfaction in online learning. Among those factors, presence has been reported as an important one. Studies in a computer-mediated-communication demonstrated that social presence is a significant predictor of students’ satisfaction in online learning (Cobb, 2009; Gunawardena & Zittle, 1997; Hostetter & Busch, 2006; Richardson & Swan 2003).

Further, Russo & Benson (2005) found a relationship between students' perception of the presence of other students, namely co-presence and satisfaction.

The concept of presence and satisfaction has become an important research topic in 3D virtual world literature, as well. 3D virtual worlds have different affordances than 2D virtual learning environments which would affect presence and satisfaction in a different way. Representational fidelity and the learner interaction in 3D virtual worlds are the two important characteristics that distinguish them from the 2D virtual learning environments (Dalgarno & Lee, 2010).

Representation of the environment with three dimensions, texture, light, sound, motion and other details can bring realism to the virtual world environment. These characteristics can make the individuals feel immersed in the environment. Consequently, feeling of immersion can affect the individuals' sense of being in the environment. Individuals can feel that they are in the virtual environment and part of it, even though physically they are not. Individuals can also remember the virtual place as if they see it in the real life. These characteristics can facilitate the construction of presence in general, and place presence specifically.

In 3D virtual worlds, individuals are represented visually by their unique identity and avatars. Peterson (2005) defined avatars as 'online manifestations of self in a virtual world, and are designed to enhance interaction in a virtual space' (p. 30). Avatars are not only the visual representation of the individuals but also they are the viewpoint in the 3D virtual worlds (Dickey, 2005). Individuals can control their avatars in the virtual world by walking, running, flying, and communicating with others by using some gestures like raising hand, waving, etc. In addition to the non-verbal communication, individuals can also engage in a verbal communication through text and audio in 3D virtual worlds. Representation with an avatar and the interactivity affordances of 3D virtual worlds can help individuals to be aware of the others and to perceive them as a real person. Individuals can socially and psychologically feel connected to the others by interacting through the avatars and they can experience greater social presence and co-

presence (Biocca et al., 2003; Schroeder, 2002). In turn, higher sense of co-presence and social presence is likely to contribute to the learners' satisfaction.

Studies showed that social presence was a vital element that affected learners' satisfaction (Hassell, Goyal, Limayem, & Boughzala, 2009; Zhang, 2010) and satisfaction and enjoyment (Barfield & Weghorst, 1993; Mansour, El-Said, & Bennett, 2010) in virtual world learning environments. However, some research studies failed to find a significant relationship between co-presence and satisfaction (Hassell et al., 2009).

2.4. *User characteristics*

User characteristics can play a critical role on the sense of presence in 3D virtual worlds. As stated earlier, Witmer and Singer (1998) saw individuals' involvement and immersion as necessary to experience presence. Therefore, individuals' immersive tendencies are the important user characteristics that affect presence. Witmer and Singer's (1998) studies indicated that immersive tendency scores of the individuals predicted the level of place presence in virtual environment. However, other studies failed to replicate the finding regard to relationship between immersive tendency and presence when they used Witmer and Singer's (1998) presence questionnaire (Casanueva, 2001; Jonhs et al., 2000). On the other hand, Casanueva (2001) found that immersive tendency was a strong predictor of the presence when he used presence questionnaire of Slater, Usoh, & Steed (1994). However, regarding co-presence, Casaneuva (2001) did not find a significant correlation between co-presence and immersive tendency scores of individuals.

3. Purpose of the study

Although literature suggested that presence was an important concept in virtual worlds, there are some contradictory results in terms of the relation among the different types of presences and their relationship with the satisfaction and immersive tendencies of individuals. One reason for these results in the literature might be the use of different instruments to measure the presence. In

addition, studies attempting to compare the different types of presence are few in number, leaving the researchers calling for additional studies to examine how different types of presences are related (Biocca et al., 2003; Slater et al., 2000). Therefore, the study was designed to examine the following questions:

- What is the relationship among students' perceived place, social, and co-presence in a 3D virtual world?
- What is the relationship between students' immersive tendency and their perceived place, social, and co-presence in a 3D virtual world?
- Do the students' perceived place, social, and co-presence influence their satisfaction in a 3D virtual world?

4. Method

4.1. Participants

Participants were third year pre-service teachers enrolled in Teaching Methods course at Department of Computer Education and Instructional Technology at Middle East Technical University in Turkey. A total of 46 students participated in the study with 12 female and 24 male, aged between 20 and 24. Only two students had used Second Life before, and for the last six months, but not for the educational purposes. However, 63 % of the students had gaming experiences. As shown in the Figure 1, of the students who had gaming experiences, 10 % of the students had less than sixth months, 20 % of the students had 1-3 years, 14 % of the students had 3-5 years, and 56 % of the students had more than 5 years of gaming experience. Moreover, 31 % of the students spent less than an hour, 45 % percent of the students spent 1-5 hours, 17 % of the students spent 6-10 hours, and 7 % of the students spent 11-15 hours in a week playing games as shown in the Figure 2.

Insert Figure 1 and 2 about here

4.2. *Virtual world environment and procedure*

Second Life METU Campus was used to provide the virtual world to the students enrolled in Teaching Method course. Teaching Methods course aims at providing theoretical foundations behind the teaching methods and techniques as well as the application of the methods in the classroom. Different activities were designed for the course, including small group work, large group discussion, and role playing sessions. Students involved in these activities in Second Life METU Campus throughout the course of one semester.

Students first completed a demographics questionnaire at the beginning of the study. Then, they involved in one-hour orientation sessions through three weeks. Although one third of the participants had gaming experiences more than five years, all of the students, except two of them, was new to Second Life virtual world. Since it was a different platform for them, they needed some basic information; and during these orientation sessions, they created their avatars and got some information about the basics of Second Life including editing the profile, editing the appearance, adding friends, using the inventory, and basic communication and movements skills.

Afterwards, they started working in a group of four people to prepare wiki pages and posters in-world for the assigned teaching methods. For this activity, students worked both synchronously and asynchronously. Students also involved in the synchronous role-playing activities to implement different teaching techniques in virtual classrooms. Moreover, meetings with the instructor and course assistants were held to facilitate the communication within the large group. Students also communicated with each other in the social area throughout the semester. At the end of the study, students completed a questionnaire about their presence, satisfaction, and immersive tendencies.

4.3. *Data collection and instrument*

Pre-questionnaire was used to collect the demographic information about the participants. The questionnaire consisted of items, including age, gender, gaming and Second Life experiences.

Most of the studies in the literature used subjective questionnaires to measure the presence. Post-questionnaire was prepared by adapting and modifying these existing instruments. The questionnaire used in the study consisted of four parts: Place presence (PP), co-presence (CP), social presence (SP), and satisfaction (S).

The scales for PP and CP were adapted from Slater and his colleagues' studies (Slater et al., 1994; Slater, Steed, McCarthy & Maringelli, 1998; Slater et al., 2000). The PP scale was based on three main themes: the sense of being in the place, the extent the virtual environment becomes a real, the extent the virtual environment is remembered as place. The CP scale was based on the two aspects including the sense of being part of a group and individuals' perception of the others' co-presence. PP and CP questionnaires consisted of 5 and 3 items, respectively. Each item was rated on a seven-point Likert scale, ranging from 1 (Not at all) to 7 (Very much). PP and CP scores were calculated by summing up the item scores in the questionnaire. Reliability analysis showed that Cronbach's alpha was .70, .71 for PP and CP, respectively.

The scale for SP was adapted by Kreijns, Kirschner, Jochem, and Buuren (2007). The SP scale consisted of 10 items. The scale for S was modified from Chou and Liu (2005) and it consisted of 4 items. SP and S items were measured with a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). Reliability analysis showed that Cronbach's alpha was .81 and .85 for SP and S, respectively.

Additionally, Witmer and Singer's (1998) Immersive Tendency Questionnaire (ITQ) was used to measure the difference in the tendencies of the individuals to experience presence. ITQ items measured the involvement of the individuals in the common activities and tendency to focus or redirect attention. The original ITQ included 18 questions. Three questions "How physically fit do you feel today" and "How mentally alert do you feel at the present time?" and "How often do you play arcade or video games" were not used. Statements in ITQ were on a seven-point scale, 1 (never), 4 (occasionally), 7 (very often). Immersive Tendency scores were

calculated by adding the individual scores of each question in the questionnaire as suggested by Witmer and Singer (1998). The range of possible scores was 15-105. The reliability analysis of the ITQ for the current study showed that Cronbach's alpha was .86.

4.4. Data analysis

The collected data were analyzed by using SPSS 12.0. Correlation analyses were conducted in order to examine the relationship among the place presence, social presence, and co-presence. Moreover, correlation analyses were conducted to explore the relationship between the types of the presence and the immersive tendency scores.

Moreover, multiple regression analyses, a technique recommended by Cronbach and Snow (1977), were conducted to examine how the different types of presence would predict the satisfaction in virtual worlds. For the regression model, the criterion variable was the satisfaction score. There were three predictor variables, including place presence, social presence and co-presence scores. All of the predictor variables entered into the regression equation simultaneously. As Thompson and Borrello (1985) and Courville and Thompson (2001) suggested, both beta weight and structure coefficients were used in interpreting the regression analysis.

5. Results

Pearson's product-moment correlation coefficients were calculated to find the statistical relationships among three types of presence and immersive tendency of students. Table 1 shows the correlation coefficients of these relationships. A statistical positive relationship was found between place presence and social presence scores ($r = .52, p < .01$); between place presence and co-presence scores ($r = .56, p < .01$); and social presence and co-presence scores ($r = .34, p < .05$). Moreover, the results indicated that while immersive tendency score was significantly correlated with place ($r = .34, p < .01$) and co-presence ($r = .42, p < .05$), it was not significantly correlated with the social presence.

Insert Table 1 about here

Summary of the multiple regression analysis for the variables predicting satisfaction is presented in Table 2. The results of the analysis showed that overall regression model was significant, $R^2 = .31$, $F(3, 42) = 6.15$, $p < .001$. Namely, the variables, place presence, social presence, and co-presence together accounted for % 31 of the variation in the satisfaction scores. Examination of both beta weight and the squared structure coefficients indicated that social presence was the best predictor of the satisfaction scores of students, explaining 92 % of the total variance. Although beta weight for place presence and co-presence was not significant, the squared structure coefficient was significant, accounting for 29 % and 32 % of the total variance, respectively.

Insert Table 2 about here

6. Discussion

This study investigated the relationship among the place presence, social presence, and co-presence and their relationship with the satisfaction and immersive tendencies of the students. The findings of this study revealed that (1) There was a significant relationship among the place, social, and co-presence. (2) Immersive tendencies of the students were related to their place and co-presence but not to their social presence. (3) Place, social, and co-presence were the predictors of the students' satisfaction. Figure 3 summarized the findings of the study.

Insert Figure 3 about here

6.1. Place presence, social presence, and co-presence

The first research question aimed at examining the relationship among the students' perceived place, social and co-presence in 3D virtual worlds. Findings of this study indicated that there was

a positive correlation between place presence and co-presence, which is consistent with the previous research (Axelsson et al., 2001; Biocca et al. 2003; Schroeder, 2002 ; Slater et al., 2000; Tromp et al., 1998). It can be concluded that students who felt present in the virtual environment also tended to feel the sense of being together. In line with the literature, it can be suggested that realism features of the virtual environment made the immersion possible as well as the psychological interaction of the students (Nowak, 2001; Schroeder, 2002). When students perceived and remembered the virtual environment like the place in a real life, they could also have the sense that they were available and accessible to one another. Therefore, it is suggested that the students who feel involved in the virtual environment also tend to feel the mutual awareness in the group.

The results of this study also revealed that the students who reported higher place presence also perceived higher level of social presence. It is likely that students who felt physical presence in the virtual environment as the real place also tended to perceive the environment as more personal and sociable that increased the intimacy and immediacy. This positive relationship between place presence and social presence was consistent with the previous research (Thie & van Wijk, 1998).

While some of the researchers suggested that co-presence was related to the place presence, some researchers stated that it was also related to social presence (Biocca, 2003). This is supported by the results of this study in that the students who reported higher co-presence had also sense of higher level of social presence. It can be concluded that the students who perceive the quality of the medium as to create more intimate interactions also tend to feel the psychological togetherness in virtual worlds. Especially, the representation through avatars and using both verbal and non-verbal communication channels would make it possible for students connect to each other both socially and psychologically (Biocca et al., 2003; Schroeder, 2002).

Contrary to the findings of this study and the researchers who suggested positive relationship among the types of the presences, some researchers suggested that place presence can be orthogonal with co-presence (Bystrom & Barfield, 1999; Casanueva, 2001) and social presence (Wang & Wang, 2011). Although this might be a case in the real life, this study suggested that all types of presences, place, social, and co-presence were related in virtual environment.

6.2. Immersive tendency and presence

Other relationship of concern was the one between immersive tendency and perceived place, social, and co-presence of students in 3D virtual worlds. The findings revealed the positive relationship between immersive tendency and place presence scores of the students. It can be concluded that the students who have higher tendency to involve and focus on the common activities in real life also tend to feel present in the virtual environment. The findings are in line with the literature that immersive tendency is a predictor of the place presence (Casanueva, 2001; Jonhs et al., 2000; Witmer & Singer, 1998).

Although some studies did not find a correlation between immersive tendency and co-presence (Casaneuva, 2001), this study found that immersive tendency was significantly related to co-presence. Namely, the students who had higher tendency to focus on the real life activities also tended to feel the mutual awareness in the virtual environment. As suggested in the literature, immersive tendency is an important individual characteristic to experience the co-presence (Heeter, 1992). This finding is meaningful since co-presence is related to the some properties of the place presence (Biocca et al., 2003).

Unlike place presence and co-presence, the findings indicated that immersive tendencies and social presence scores of the students are not related. While there is no previous research which specifically examined the relationship between immersive tendency and social presence, this finding supports the idea that social presence could be related to the course design and activities other than their immersive tendencies.

6.3. Presence and Satisfaction

Final research question was to explore if the students' perceived place, social, and co-presence influenced their satisfaction in 3D virtual worlds. Among the types of the presences, social presence was found to be the best predictor of the learners' satisfaction. Namely, the students who perceived greater social presence were more satisfied with the virtual world experience. It can be concluded that when virtual world environment made possible for students to connect to their peers easily and allow informal conversations, they felt more comfortable, they don't feel lonely, and they would be more satisfied with the learning experience. The findings are in line with the literature that social presence is a very important factor that affects learners' satisfaction and enjoyment in virtual world learning environments (Hassell et al., 2009; Mansour et al., 2010; Zhang, 2010).

The findings of this study also revealed that place presence and co-presence were also important factors that affected learners' satisfaction. When students had the sense that they were in the same place as the other students and they were part of the group, they felt more satisfaction. This finding contradicted the previous research of Hassell et al. (2009) who found no relationship between co-presence and satisfaction. On the other hand, Hassell et al. (2009) explained their finding as a result of the fact that the students were novice users of the 3D virtual environment.

7. Conclusion

The study of presence has been an important part of the research in virtual worlds. However, there are different views about the relationship among the different types of presences. The findings from this study might highlight some important issues related to the relationship among the different types of presences. The result might contribute to the conflicting literature on presence suggesting that place, social, and co-presence are related to each other and they are

important for the satisfaction. Moreover, while social presence seems to affect the satisfaction most, immersive tendencies are related more with the place presence and co-presence.

Findings of this study can inform the designers of the virtual world environments. Although learners tend to be more satisfied when they have a higher social connection, expressing feelings in the environment towards the other group members is also an important issue. Therefore, it is important to consider the realism feature of the environment as well as the course design and the activities to increase presence and satisfaction of learners. Moreover, designers should consider the immersive tendencies of the learners when designing such environments.

Although modified replication of the study by adding more participants would strengthen the results, the present analyses still provide suggestive evidence for the different types of presences and their relation to the satisfaction and immersive tendencies of the learners. However, this study is limited to the Second Life virtual world and the environment used in the study. Further studies can examine the relationship among the presences in different virtual worlds with different activities. Moreover, further studies can examine the causality between the different types of presences. This study did not examine gender and gaming experiences as factors, but further studies with larger sample would explore how those individual characteristics along with others might influence presence and satisfaction.

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Table 1

Pearson's correlation coefficients

Variable	Place presence	Social presence	Co-presence	IT
Place presence	-			
Social presence	.52 **	-		
Co-presence	.56 **	.34 *	-	
IT	.34 *	1.64	.42 **	-

* $p < .05$, ** $p < .01$.**Table 2**

Summary of the multiple regression analysis

Variables	<i>B</i>	<i>SE B</i>	β	r_s	$(r_s)^2$
Place Presence	-.009	.677	-.061	.54 ***	.29
Social presence	.594	.034	.502 **	.96 ***	.92
Co-presence	.04	.025	.181	.57 ***	.32
$R^2 = .31$ ($p < .001$)					

** $p < .01$, *** $p < .001$



Fig. 1. Gaming experiences of participants

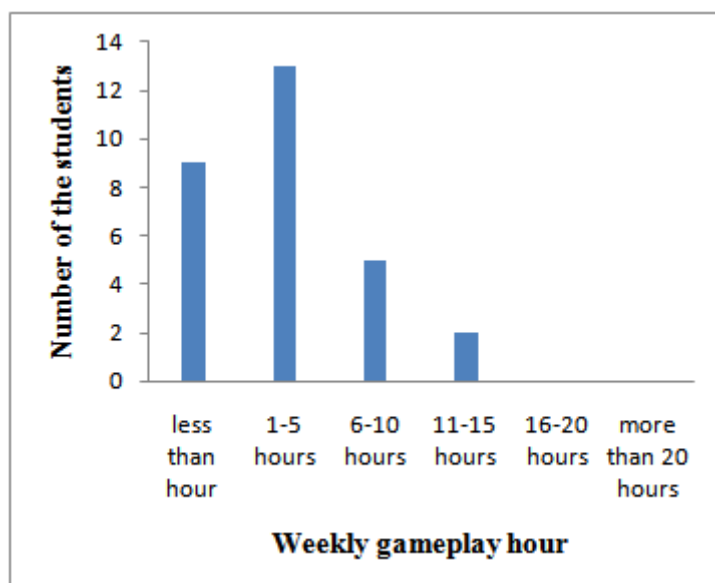


Fig. 2. Weekly gameplay hour

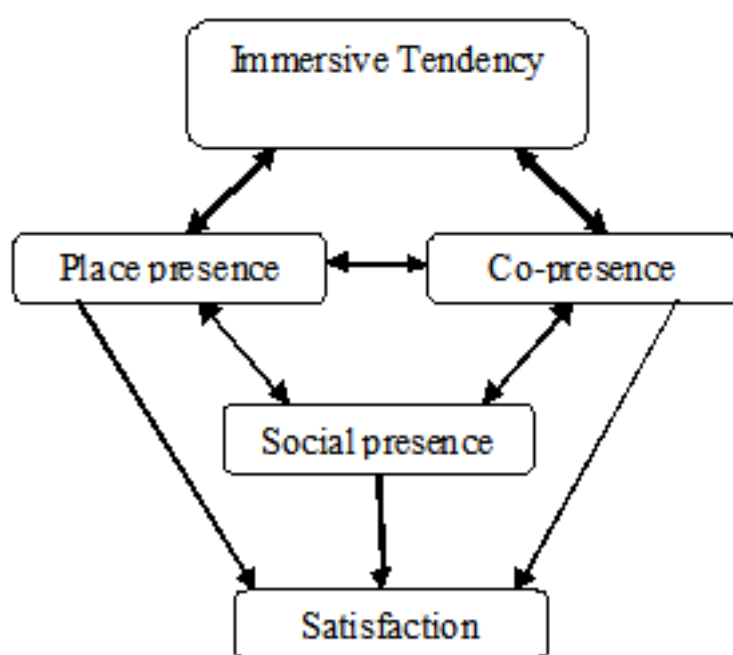


Fig. 3. Relationship among the presence, immersive tendency, and satisfaction

- We examine the relationship among different types of presence in virtual worlds.
- We examine the relationship between presence, immersive tendency, and satisfaction.
- There was a significant relationship among the place, social, and co-presence.
- Immersive tendency were related to place and copresence but not to social presence.
- Place, social, and co-presence were the predictors of students' satisfaction.